NEWSLINE

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Getting to the bottom of the. . . periodic table

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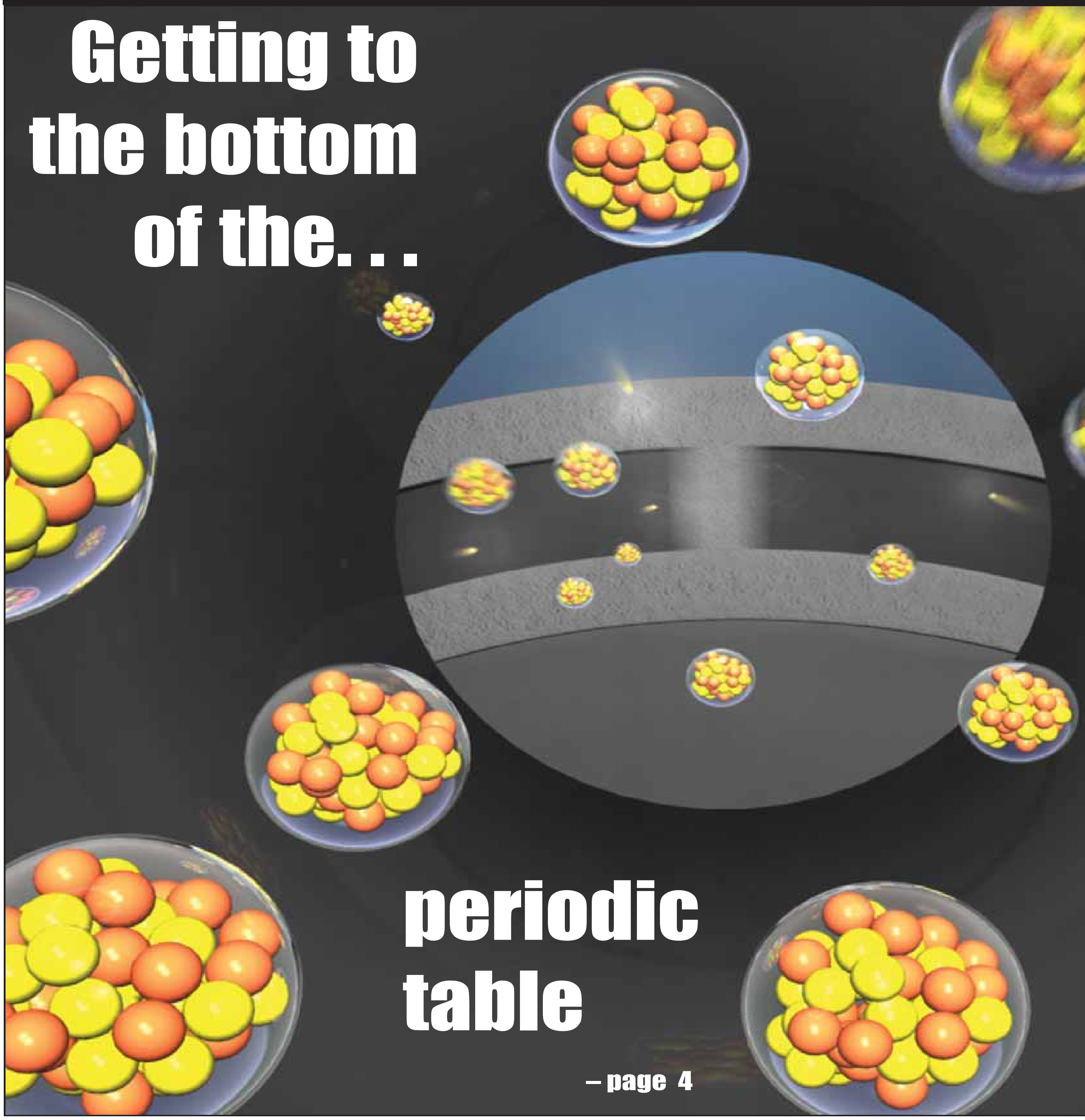
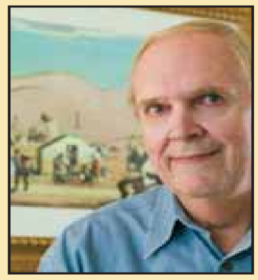
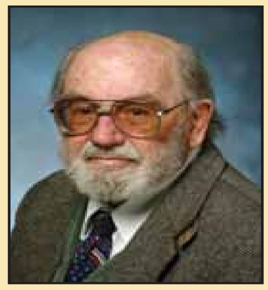


WHAT'S INSIDE



A look at NTS before nuclear testing

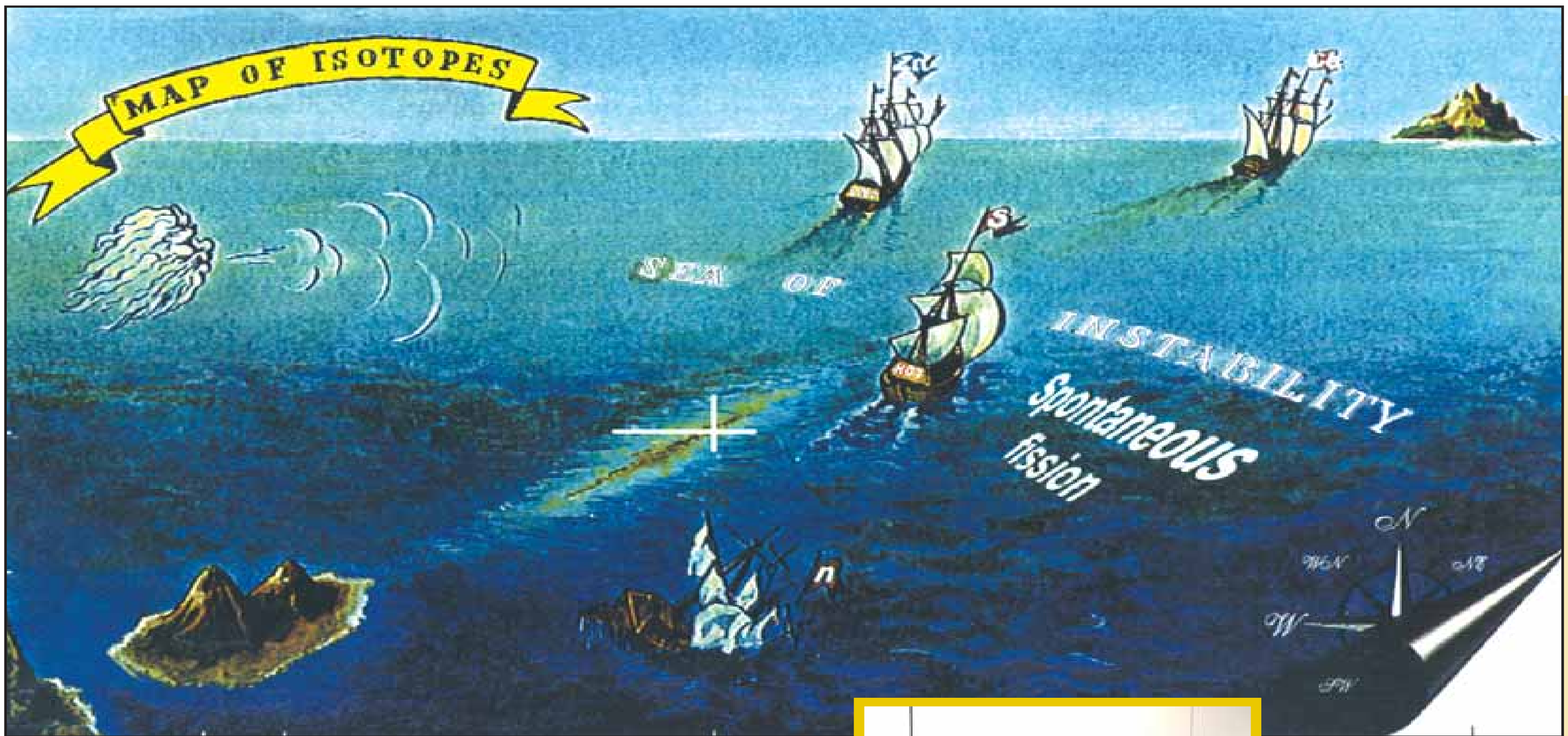


Hans Bethe award for Jim Wilson

HOME Campaign builds momentum

SCIENCE NEWS

Element team looks for 'magic number'



SABRINA FLETCHER AND THOMAS TEGGE

Top: The Island of Stability is a term from nuclear physics that describes the possibility of elements, which have particularly stable "magic numbers" of protons and neutrons. This would allow certain isotopes of some transuranic elements (elements with atomic numbers greater than 92) to be far more stable than others, and thus decay much more slowly.
Inset: A particle begins to decay and eventually fissions.

By Anne M. Stark
Newsline staff writer

It could be dubbed voyage to the bottom of the periodic table of elements.

That's the journey that the Heavy Element Group in the Chemistry, Materials and Life Sciences Directorate is on. And they recently came one step closer as they joined with Russian scientists to discover the newest superheavy element, element 118.

LLNL scientists collaborated once again with researchers from the Joint Institute for Nuclear Research in Russia (JINR) to bring the total to five new elements for the Livermore-Dubna team (113, 114, 115, 116 and 118).

In experiments conducted at the JINR U400 cyclotron in 2002 and again between February and June 2005, the researchers observed atomic decay patterns, or chains, that establish the existence of element 118. In these decay chains, previously observed element 116 is produced via the alpha decay of element 118.

The results are published in the October 2006 edition of the journal, *Physical Review C*. The paper appears online at http://link.aps.org/abstract/PRC/v74/e044602.

The experiments produced three atoms of element 118 when calcium ions bombarded a californium target. The team then observed the alpha decay from element 118 to element 116 and then to element 114. The Livermore-Dubna team had created the same isotope of element 116 in earlier experiments.

"The decay properties of all the isotopes that we have made so far paint the picture of a large, sort of flat Island of Stability and indicate that we may have luck if we try to go even heavier," said Ken Moody, a team member who has worked in the heavy element field for 29 years.

The Island of Stability is a term from nuclear physics that describes the possibility of elements, which have particularly stable "magic numbers" of protons and neutrons. This would allow certain isotopes of some transuranic elements (elements with atomic numbers greater than 92) to be far more stable than others, and thus decay much more slowly.

Livermore researchers say that if they can achieve an element with at least 184 neutrons, they may just reach the island.

"We don't have enough neutrons to get in the center of the Island of Stability," Moody said. "We're just on the edge. We're nibbling away at the shores of the Island of Stability but our feet are still wet."

Element 118 is expected to be a noble gas that lies right below radon on the periodic table of elements.

"The world is made up of about 90 elements," Moody said. "Anything more you can learn about the periodic table is exciting. It can tell us why the world is here and what it is made of."

Members of the Livermore team include: Moody, Dawn Shaughnessy, Mark Stoyer, Nancy Stoyer, Philip Wilk, Jacqueline Kenneally, Jerry Landrum, John Wild, Ron Lougheed and former LLNL employee Joshua Patin.

"This is quite a breakthrough for science," said Chemistry, Materials and Life Sciences Associate Director Tomas Diaz de la Rubia. "We've discovered a new element that provides insight into the makeup of the universe. For our scientists to find another piece of the puzzle is a testament to the strength and value of the science and technology at this Laboratory."

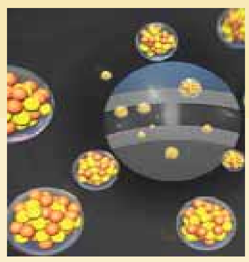
Livermore has had a long-standing heavy element group since the inception of the Laboratory in 1952. The group has been successful in the discovery of several new elements over the years because it has access to unique materials to perform the experiments. In 1999 and 2001, the Laboratory announced the discovery of elements 114 and 116, respectively. In 2004, the Livermore-Dubna team observed the existence of elements 113 and 115.

As for the future, the LLNL-Dubna team will continue to map the region near the Island of Stability. In 2007, the team plans to look for element 120 by bombarding a plutonium target with iron isotopes.

"The heavy element community will continue to search for new elements until the limit of nuclear stability is found," Mark Stoyer said. "It is expected that limit will be found."

And as for whether the team truly found element 118, one has only to turn to Nancy Stoyer.

"We're very confident," she said. "I think of this like any other journey to a new place. Why do you want to go to the moon? Why do you want to go to the top of Mount Everest? Finding it is something new, something interesting."



ON THE COVER: ARTIST'S CONCEPTION OF CALCIUM IONS TRAVELING DOWN THE ACCELERATOR AT A HIGH VELOCITY TOWARD THE ROTATING CALIFORNIUM TARGET.
ART BY SABRINA FLETCHER AND THOMAS TEGGE